TECHNIQUES FOR COLLECTING AQUATIC AND MARSH PLANTS[1]

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Aquatic and marsh plants are those species occurring in substrates saturated with water most or all of the year. These substrates may be inundated permanently or may have the water table at the substrate surface. This habitat often poses a barrier to the collector and special problems in specimen preparation. As a result, aquatic and marsh plants are often inadequately collected and, therefore, poorly represented in herbaria.

When collecting for aquatic or marsh species, I examine almost every wet spot, pool, lake, or stream I encounter and wade to the plants, if necessary. The substrate is often quite muddy and I may sink to the knees or deeper. When the water is too deep to wade, I prefer using a small boat and then dragging the substrate with a rake or grappling hook (one constructed from pipe ca. 20 cm long by 2 cm wide, coat-hanger, and rope ca. 10 m long is adequate). One can, of course, stand on shore and toss the grappling hook into the bed of plants, if the plants are fairly close.

It is important to make complete specimens, including stems, leaves, roots, and reproductive structures—preferably mature flowers and fruits—of aquatic and marsh plants. Both staminate and carpellate flowers should be collected for taxa with imperfect flowers, e.g., Hydrocharitaceae. Sterile specimens should be collected only for those taxa, e.g., Lemnaceae, that are so rarely seen in flower that the taxonomy is based upon vegetative features. Some persons believe that aquatic habitats are visited so rarely that it is better to collect a sterile specimen than none at all. However, if the specimen cannot be determined, it might as well be left in nature.

Label data are especially important with aquatic or marsh plants. Information other than normal locality data that should be included are depth of water; flow rate of water; range of leaf size; whether leaves are submersed, floating, or emergent; color of flower; odor of flower; time of day of flowering; whether flowers are submersed, floating, or emergent; and whether fruits are submersed, floating, or emergent.

Care must be taken to prepare quality specimens of aquatic vascular plants. They normally do not need to be pressed immediately following collection. I usually wrap each collection in dry newspaper and store these wrapped collections in plastic bags or styrofoam chests. These bags or chests are kept in the shade to prevent overheating the plants. The moisture from the specimens is adequate to moisten the newspaper and to keep the specimens fresh and pliable for several hours. The plants can be pressed later that day when one has ample time to do the task carefully.

Several taxa, e.g., *Heteranthera* and *Utricularia,* have delicate flowers that are destroyed or from which the corolla falls off in the bag or press. Two or three flowers of these taxa should be preserved in 50% aqueous methyl or ethyl alcohol solution. Plastic 20 ml vials are excellent for this. Also, the "duckweed press," which is discussed later, works well for pressing these flowers.

Many species of aquatic and marsh plants have fairly large bulky stems, leaves, and subterranean parts. These large organs pose special problems when pressing. First, all parts of a specimen, other than the bulky structures, will have inadequate pressure in the press; as a result, they shrink during the drying process. This shrinking can be corrected by placing layers of newspaper on the flatter parts while the plant is in the press. Second, these bulky organs tend to have large amounts of water and, therefore, dry slowly—so slowly, in fact, they may completely decay while in the press. This decaying can be eliminated by splitting the large structures before pressing and by changing the corrugates and blotters of the press each day.

Delicate aquatic plants, especially those that

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grow submersed, need to be floated (see explanation below) onto a sheet of paper prior to pressing. I prefer to float the specimens onto half sheets of newspaper. These sheets are then placed between folded newspaper—the "pressing paper"—for pressing. I float and field press these delicate specimens at the time of collecting, rather than in the evening, so that I may use the body of water in which they were growing for floating. This procedure eliminates the need to take a pan for specimen floating on collecting trips.

The specimens are floated by placing the plant in water with the half sheet of newspaper below. After the plant is positioned properly on the paper, it is held in place to the top of the paper by the thumb as the newspaper is slowly lifted from the water. The paper is lifted in a manner so that water flowing from the paper separates the leaves, and the specimen adheres to the wet paper.

Some plants often have mucilages, either produced by the plant itself or by epiphytic algae, and, as a result, will stick to the half sheet and pressing paper upon complete drying. To prevent this sticking, I place the folded pressing paper between two sheets of blotting paper with minimal pressure and leave them for four to six hours at ambient temperature. This time period allows excess water to be absorbed by the blotting paper but does not allow adequate time for complete drying of the specimen. The specimens are then carefully removed from the pressing paper (including the half sheet), placed between unused, dry, folded newspaper, and pressed as usual. This transfer is done at the end of the collecting day when all other pressing is accomplished. Specimens rarely stick to the paper following this treatment. This procedure works quite well with such delicate species as those of *Utricularia*. Taxa that are extremely mucilaginous, e.g., *Brasenia*, may still stick to the paper even after this procedure. My students and I have found that these specimens are less likely to stick if they are pressed in folded nylon screen (available at local hardware stores) rather than paper. The screen is then placed between two blotters of the press. This screen should be used only with rather coarse taxa because it will damage delicate tissue.

If there is no time to change the paper, then one may wish to place waxed paper on one side only of the specimen to prevent it from sticking to the top sheet of the pressing paper. I do not use this technique, since the specimen will stick to the sheet used for floating. If the waxed paper technique is utilized, then the collector must float the specimen onto some good quality paper, such as bond typing paper or herbarium paper. Waxed paper works quite well with vegetative parts, but it will stick to delicate corolla lobes, such as those of *Utricularia*. These corolla lobes, however, do not stick to newsprint. Thus, a small section of the waxed paper should be torn off so that the waxed paper will not cover the corolla.

When pressing plants with whorled, dissected leaves, e.g., *Myriophyllum*, it is useful to section one node and float that node onto a small portion of paper. The number of leaves per whorl, as well as the number and arrangement of segments per leaf, are often important in these dissected-leaved plants. A single node floated onto a small section of paper makes observing these characteristics much less difficult.

The shape of stems or petioles may be important for identification of aquatic or marsh plants. These structures have large lacunae and, as a result, may collapse during pressing. Therefore, cross sections of stems and petioles should also be pressed to indicate the shape.

Specimens of Lemnaceae are often *very* poorly prepared. Wads of these plants—as well as snails, insects, small sticks, and other debris—are often smashed between folded newspaper during usual pressing. One obtains, from such a preparation, a mass of individuals seemingly welded together. Duckweeds are much better prepared by storing them in 50% methyl or ethyl alcohol in the field and by pressing them later in the laboratory. I take into the field 25–30 plastic bottles, each with a capacity of ca. 250 ml. At least one-third of these bottles is filled with absolute methyl or ethyl alcohol. When a population of Lemnaceae is located, the plants are collected by skimming a tea strainer or dip net (available at aquarium stores) along the surface of the water. I fill a bottle about half full with the plants. Then an aqueous solution of ca. 50% (v/v) methyl or ethyl alcohol is prepared and the bottle is filled with this solution. I use the water in which the plants were growing to prepare the solution. The plants will remain without deterioration for several weeks. The chlorophyll, of course, will be bleached out, but all important characteristics will remain. Once back in the laboratory, and following identification, the specimens are sorted by taxon onto standard index cards and are pressed. Special "duckweed presses" (designed by Howard Clark) can be made from pressing corrugates that are cut into sections the same size as the index cards. I do not use blotters or newspaper, but if they

are used, they would be cut to sizes equal to the index cards. Neither frames nor straps are used with the press. Instead, one rubber band (ca. 7 mm wide and 75 mm in diameter) is placed around the press in the short direction for pressure. This rubber band gives enough pressure to keep the plants flat but not so much that the plants are welded to the paper. When the specimens are dried, two or three cards of each taxon prepared by this technique are placed inside a packet constructed from 100% rag typing paper and the packet is glued onto an herbarium sheet.

Members of the Nymphaeaceae and Nelumbonaceae are mostly large and difficult to press. Since flowers and fruits are important in the taxonomy of these taxa, these structures should be pressed open or split lengthwise so that the internal structure can be observed. One or two leaves are all that need be pressed for each specimen.

Michaelis (1981) has proposed using 50% glycerol (v/v aqueous) as a storage medium for all aquatics prior to pressing. I can see no value to such an approach because it would necessitate, for prolonged trips, transporting large amounts of glycerol. Also, specimens carefully processed by usual pressing techniques are equal to or better in quality than those prepared with the glycerol technique. This technique might be of value when one wishes to save some of the material in the three-dimensional form for teaching purposes, however.

Literature Cited

Michaelis, F. B. 1981. Preservation of freshwater macrophytes using glycerol. Aquatic Bot. 11: 389.